Note on Star Corrections in N.P.D. By W. E. Cooke.

(*Communicated by the Secretaries.*)

In a letter to the Astronomer Royal, dated 1894 January 23, Sir Charles Todd, the Director of the Adelaide Observatory, writes:—"Anything which will facilitate the reduction of our observations is so important that I shall not apologise for submitting to you a simple method which my first assistant, Mr. W. E. Cooke, M.A., has devised for reducing our Z.D. observations to mean N.P.D. January 1, respecting which I shall be glad to have your valuable opinion, and should it be favourable it may be brought before the Royal Astronomical Society."

The letter and notes on the method were handed by the Astronomer Royal to the Secretaries, who have drawn up the present note on the method.

The star correction in declination is, according to Bessel's notation,

$$Aa' + Bb' + Cc' + Dd',$$

where

$$a' = \tan \omega \cos \delta - \sin \alpha \sin \delta, \quad b' = \cos \alpha \sin \delta,$$
$$c' = 20''{\cdot}0524 \cos \alpha, \text{ and } d' = -\sin \alpha.$$

Of this expression part depends on both α and δ, part on α alone, and part on δ alone, as is seen by the alternative form of the correction tabulated in the *Nautical Almanac*, viz.:

$$i \cos \delta + g \cos (G + \alpha) + h \cos (H + \alpha) \sin \delta.$$

The procedure adopted by Mr. Cooke is (1) to leave untouched the computation of the part depending on both α and δ, i.e.,

$$h \cos (H + \alpha) \sin \delta,$$

or in the other notation

$$-A \sin \alpha \sin \delta + B \cos \alpha \sin \delta,$$

which is performed by the additions of two sets of three logarithms; (2) to simplify the computations of the other parts by tables and diagrams. The part $g \cos (G + \alpha)$ or $Cc' + Dd'$ is tabulated for each hour of R.A. and for every ten days throughout the year. On each night the values of this quantity are plotted in a curve for the hours of R.A. occupied in observation, and from this curve is read off the value of the term for every star in turn. Similarly, the part $i \cos \delta$, or $A \tan \omega \cos \delta$, is tabulated for every 10° of declination and every ten days throughout the year, a curve being constructed for each night of observation from the tables. These tables are of universal application, and if adopted at other observatories it might be advisable to extend them considerably.

It should be remarked that constants are added at various parts of the work to obviate the use of algebraic signs.

On Star Corrections. By Professor H. H. Turner, M.A., B.Sc.

1. The foregoing paper by Mr. Cooke affords an opportunity for putting down some notes on this subject, which has occupied my attention at intervals for some years past.

2. To the end of the year 1885 star corrections were computed at the Royal Observatory, Greenwich, by means of Airy's constants and day numbers, which were essentially those of Bessel, slight modifications being made so that algebraical signs were avoided. The day numbers were printed in the *Nautical Almanac* to the year 1890, but discarded when it was known that they were no longer required at Greenwich. The "star constants" were printed in the Greenwich Catalogues up to and including the Nine Year Catalogue 1872; and their computation was a serious addition to the labour of constructing the Catalogues.

3. There were several reasons for making a change, but the two chief were—

(*a*) The adopted procedure was found to be cumbersome.

(*b*) The use of the so-called "star constants" from year to year was found to be a fruitful source of errors, both because the numbers were not really "constants" and their slow change were apt to be neglected too long, and because errors were made in copying.

4. From 1886 January 1 Mr. Stone's "Tables for facilitating the computation of star constants" have been regularly used. All the computations are made independently in duplicate, and the results compared. A time about equivalent to the whole time of two computers is thus occupied in the computation of star corrections. If the meridian observing were in any way distributed in zones, this labour might of course be considerably reduced; but distributed, as it is at Greenwich, to all zenith distances indiscriminately, there is no way of reducing the labour except by simplifying the processes, if possible.

5. Mr. Finlay, in *Monthly Notices*, vol. l. p. 497, gives a method which certainly has advantages, and Mr. W. E. Cooke's method, given above, also seems to me to be a distinct simplification. My only doubt is whether the advantages gained in either case are quite sufficient, say, to make a change at Greenwich desirable. At the same time the question of saving labour is one of great importance, and the matter cannot be too thoroughly discussed. I have tried various methods during the last few years; in the first instance various forms of tabulation, which after many trials were found to be too cumbrous; and latterly different mechanical devices. At least four mechanical devices have been tried with fair success, as shown by models in wood and paper; but I do not propose to call attention here to more